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Proposed Approach for Making SMA Services Transparent to SSA Users

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1 Overview

1.1 General

TDRS H, I, J will offer a new S-band Multiple Access (MA) capability known as SMA. The SMA capability is a significant improvement over the current MA capability. Some current SSA users will be able to obtain satisfactory S-band support by use of the SMA services. This paper outlines an approach that will allow such SSA users to use SMA services without modification to their systems.

1.2 Operations Concept

This approach allows current SSA users to use TDRS H, I, J SMA services without modification to their systems and with no change to the format or content of any external message. SSA users will be able to obtain equivalent SMA services. For specified customers, valid schedule request for SSA services can result in the scheduling of SMA services if the request applies to TDRS H, I, or J.

The general scenario is as follows:

a. Customer submits request for SSA services.

b. If request applies exclusively to TDRS H, I, or J, the NCCDS substitutes SMA SSCs for the SSA SSCs referenced by the request.

c. SMA services are scheduled.

d. Within USMs, SMA service formats are translated to SSA service formats.

e. If the customer submits an SSA service GCMR for an SMA service, the NCCDS accepts the GCMR and formats SMA OPM.

f. Upon receipt of SMA performance data, the NCCDS translates this to SSA format.

1.2.1 Limitations

1.2.1.1 Users

This approach has three limitations:

a. Many SSA users will need to be able to schedule both SMA and SSA services on TDRS H, I, J. In such cases, the user will have to maintain two sets of SSA SSCs:

   1. SSA SSCs that will result in the scheduling of SSA services on all TDRSs.

2. SSA SSCs that will result in the scheduling of SSA services on TDRS A, C-G; but will result in the scheduling of SMA services on TDRS H, I, J.

b. Presumably the customer schedule requests for TDRS H, I, J would be developed based on SSA visibility. Usable SMA view periods could be significantly smaller. If SMA services are scheduled based on SSA view periods, some customers may experience marginal performance at the beginning and at the end of the scheduled services.

c. If an SSA schedule request refers to a TDRS set containing a mixture of old (i.e., TDRS A-G) and new (i.e., TDRS H-J) TDRSs, the NCCDS will attempt to schedule only SSA services. There will be no translation to SMA.

1.2.1.2 NCC Operators

When the NCCDS schedules SMA services for SSA users, this will noticeable to the NCC operators in two ways:

- During verbal communications with the users, the users will refer to SSA services while various NCCDS scheduling displays present SMA service information to the NCC operators.
- ODM displays will present SMA data in SSA format. This will involve the addition of default values for some parameters. This might also result in displays that would give the impression that an SA antenna had been over-scheduled.

1.3 NCCDS Impacts

The following areas of the NCCDS are affected:

- Database
- Schedule message input
- Schedule message output
- GCMR processing
- Performance Data

2 Database

The following three changes would be needed in the NCCDS database:

a. Addition of new customer parameter to indicate that the NCCDS is to make SMA/SSA transparent.

b. Addition of new parameter to SSAF SSC format to allow linkage to an SMAF SSC.

c. Addition of new parameter to SSAR SSC format to allow linkage to an SMAR SSC.

2.1 Relationship of SSAF and SMAF SSCs

The normal user SSAF SSC format contains 15 parameters. The SMAF SSC format contains 10 parameters. For an SSA user, an equivalent SMAF SSC will copy all applicable parameters from the SSAF SSC except for the SSC ID and service type parameters. The following SSAF parameters are not applicable:

a. SA Antenna

b. Service Configuration --- SMAF applies only to normal users

c. Power Mode --- SMAF does not provide a high power mode

d. Polarization --- SMAF is always LCP

e. Command Channel PN Modulation --- Always enabled for SMAF

NOTE

Although the SSAF and SMAF SSC formats both include a Receiver Frequency parameter, the range of valid values is much smaller for SMAF.

2.2 Relationship of SSAR and SMAR SSCs

For an SSAR user, an equivalent SMAR SSC will be an exact copy of the SSAR SSC except for the SSC ID and service type parameters and except for the omission of the SA antenna parameter.

NOTE

Although the SSAR and SMARF SSC formats both include a Transmit Frequency parameter, the range of valid values is much smaller for SMAR.

3 Schedule Message Input

The following logic would be added to schedule message input:

```
IF the following two conditions apply to a schedule request
        Request is for an SMA/SSA transparent customer
        Request does not apply to TDRS A - G or to a TDRS set containing TDRS A - G
THEN for each referenced SSA SSC
        IF SSA SSC is linked to an SMA SSC
        THEN
                Replace SSA SSC with SMA SSC
        ENDIF
ENDIF
```

4 Schedule Message Output

4.1 General

The following logic would be added to schedule message output:

IF USM is for SMA/SSA transparent customer

THEN

Reformat any SMAF service as SSAF.

Reformat any SMAR service as SSAR.

ENDIF

4.2 SMAF to SSAF Translation

- The value of the Service Support Subtype parameter is set 0.
- The SSAF SSC ID is replaced with the original MAF SSC ID.
- The SA antenna parameter is set to 1.
- The Service Configuration parameter is set to normal.
- The Power Mode parameter is set to normal.
- The Polarization parameter is set to LCP
- The Command Channel PN Modulation parameter is set to YES

4.3 SMAR to SSAR Translation

- The value of the Service Support Subtype parameter is set to 0.
- The SSAR SSC ID is replaced with the original MAR SSC ID.
- The SA antenna parameter is set to 1.

5 GCMR Processing

5.1 Affected Messages

The following GCMRs are affected:

a. User Reacquisition Request Message -- (Table 8-1)

b. Forward Link Sweep Request Message -- (Table 8-2)

c. Forward Link EIRP Request Message -- (Table 8-3)

d. Expanded User Frequency Uncertainty Request Message -- (Table 8-4)

e. SSA Forward Link Reconfiguration Request Message -- (Table 8-6)

f. SSA/SMA Return Link Reconfiguration Request Message Format -- (Table 8-9)

g. Doppler Compensation Inhibit Request Message -- (Table 8-11)

5.2 Logic

5.2.1 General

For the above GCMRs, the following logic would be added:

```
IF GCMR is for SSA service but SMA service is scheduled
THEN
        IF Forward Link EIRP Request Message
        Then
                Reject GCMR
        Else
                Accept GCMR
                Format OPM with SMA link identification
        ENDIF
ENDIF
```

5.2.2 SSAF and SSAR Link Reconfiguration GCMRs

Additional logic will be needed to translate a User Service Reconfiguration GCMR for an SSAF service to a User Service Reconfiguration OPM for SMAF, and to translate a User Service Reconfiguration GCMR for an SSAR service to a User Service Reconfiguration OPM for SMAR.

a. The following two parameters are valid for SSAF reconfiguration, but would be rejected for SMAF:

   – Polarization

   – Command Channel PN Modulation

b. The following parameter is valid for SSAR reconfiguration, but would be rejected for SMAR:

   – Polarization

Other aspects of the translation should be straightforward because:

- Only the parameters that are actually being reconfigured have to be translated. All other parameters will remain blank.

- The existing internal process for creating a User Service Reconfiguration OPM from a User Service Reconfiguration GCMR primarily depends on parameter names rather than on the position of parameters within the message formats.

6 Performance Data

6.1 General

Four types of messages are affected:

- OPMs
- Simulation ODMs
- SMAF ODMs
- SMAR ODMs

6.2 OPMs

The following messages are affected:

a. Return Channel Time Delay Measurement Message -- (Table 8-16)

b. Acquisition Failure Notification Message -- (Table 8-17)

c. Time Transfer Message -- (Table 8-18)

The following would be added to the output logic for the above messages:

IF message is for an SMA service for an SMA/SSA transparent customer

THEN

Set “Service Support Subtype” parameter to 1

Set “MA/SMA Return Link ID” parameter to 0

ENDIF

6.3 Simulation ODMs

The following formats are affected:

a. Simulation Forward Service Data Packet -- (Table 8-36)

b. Simulation Return Service Data Packet -- (Table 8-37)

Following receipt of the above ODM data, the following logic would be added prior to storing the messages:

IF message is for an SMA service for an SMA/SSA transparent customer

THEN

Set “Service Support Subtype/Configuration” parameter to 1

Store

ENDIF

6.4 SMAF ODMs

6.4.1 General

In terms of NCCDS output, data that would normally be output as SMAR data in the following formats:

a. MA/SMAF Service Type Header Data Packet Format -- (Table 8-31)

b. MA/SMA Forward Service Data Packet Format -- (Table 8-32)

would be reformatted so that it could be output in the following formats:

a. SA/SMAR Service Type Header Data Packet Format -- (Table 8-20)

b. SSA Forward Service Data Packet Format -- (Table 8-21)

Following receipt of SMAF ODM data, the following logic would be added prior to storing the messages:

IF data is for an SMA/MA transparent customer

THEN

Reformat and store as SSAF data

ENDIF

NOTE

This may result in the storage of ODM data for two, rather than just one, SSAF services for a TDRS H, I, J SA1 antenna. Additional logic may be needed in order to correctly retrieve this data for the appropriate user.

6.4.2 MA/SMAF Service Type Header Data Packet

For SMAF, each MA/SMA forward service data packet (refer to 9.5.5.1 of the WSC ICD) will be accompanied by an MA/SMAF header data packet (refer to 9.5.4 of the WSC ICD). In order to store the MA/SMA forward service data packet as an SSA forward service data packet, the MA/SMAF header data packet will be copied and stored as an SA/SMAR header data packet (refer to 9.5.1 of the WSC ICD). In terms of the incoming formats, these two header data packets are identical except for the value of the message type parameter and for the presence of eight spare bytes in the MA/SMAF service type header data packet.

6.4.3 MA/SMA Forward Service Data Packet

For SMAF, the MA/SMA forward service data packet (refer to 9.5.5.1 of the WSC ICD) must be stored as if it were an SSA1 forward service data packet (refer to 9.5.3.1 of the WSC ICD). Exclusive of spare parameters, the MA/SMA forward service data packet contains 10

parameters. Exclusive of spare parameters and parameters applicable only to Shuttle, the SSA1 forward service data packet contains 17 parameters. The 10 parameters from the MA/SMA forward service data packet are used as is. The remaining 7 parameters are filled-in as follows:

a. Service Support Subtype --- 1 = SSA1

b. Support Function Subgroup --- 0 = Not Applicable

c. Service Configuration --- 1 = SSA

d. Polarization --- 0 = LCP

e. Command Channel PN Modulation --- 1 = YES

f. Doppler Compensation --- 0 = OFF (TBD)

g. Power Mode --- 0 = Normal

The parameters must also be reordered.

6.5 SMAR ODMs

6.5.1 General

In terms of NCCDS output, data that would normally be output as SMAR data in the following formats:

a. SA/SMAR Service Type Header Data Packet -- (Table 8-20)

b. SSA/SMA DG1 Return Service Data Packet -- (Table 8-23)

c. SSA/SMA DG2 Return Service Data Packet -- (Table 8-24)

would be reformatted so that it could be output SSAR data in the same formats.

Following receipt of SMAR ODM data, the following logic would be added prior to storing the messages:

```
IF data is for an SMA/MA transparent customer
THEN
        Reformat and store as SSAR data
ENDIF
```

NOTE

This may result in the storage of ODM data for six, rather than just one, SSAR services for a TDRS H, I, J SA1 antenna. Additional logic may be needed in order to correctly retrieve this data for the appropriate user.

6.5.2 SA/SMAR Service Type Header Data Packet

For SMAR, each SSA/SMA DG1 or DG2 return service data packet (refer to 9.5.3.5 and 9.5.3.6 of the WSC ICD) will be accompanied by an SA/SMAR header data packet (refer to 9.5.1 of the WSC ICD). The SA/SMAR header data packet can be stored without change. It is formatted identically regardless of whether it is used for SMAR or SSAR data.

6.5.3 SSA/SMA DG1 and DG2 Return Service Data Packets

For SMAR, the SSA/SMA DG1 and DG2 return service data packets (refer to 9.5.3.5 and 9.5.3.6 of the WSC ICD) must be stored as if they are applicable to SSAR. No change to formats is necessary. Change to the values of the following four parameters are needed:

a. Service Support Subtype --- Change value from 5 to 1.

b. Service Configuration --- Change value from 4 to 1.

c. SMA Return Link ID --- Change value to ASCII space

NOTE

There are two occurrences of SMA Return Link ID.